

# An annotated avian checklist of Bornadi Wildlife Sanctuary, Assam, India

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**Abstract.** The Bornadi Wildlife Sanctuary (BWS) boasts a variety of habitats, including forest, riparian, degraded forest, and transitional zones located near human settlements and cropland. From 2019 to 2022, a thorough avian survey was conducted using the point count method, covering all habitats and seasons. The study documented 227 avian species from 65 families and 18 orders. Of the bird species observed, 72.3% were resident, and 27.7% were migratory. Over the study period, one Endangered species, three Vulnerable, and six Near Threatened species were recorded based on their IUCN Red List status. The avian diversity pattern in BWS is influenced by a variety of factors, including forest contiguity and heterogeneous habitat. Proper evaluation and management of habitats are essential for the recovery and preservation of fragile environments susceptible to decline in the region.

**Key words.** Avifauna, diversity, eastern Himalaya, heterogeneous habitats, IUCN Red List

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## INTRODUCTION

Birds play a vital role in our ecosystem, with their presence, absence, or behaviour offering valuable insights into the health and biodiversity of an area. Bird surveys have become a standard tool for assessing the health of ecosystems, especially in areas where data is scarce or limited (Bibby et al. 2000). By monitoring bird populations, scientists and conservationists can glean valuable information on climate change impacts, land use practices, and habitat degradation (Gregory and Strien 2010). In less-known areas, birds can be crucial in identifying regions with biodiversity and conservation value (Martínez-Núñez et al. 2023). For example, in the Eastern Himalayas, where there is a high level of bird endemism, bird surveys have been used to pinpoint areas that require conservation attention (BirdLife International 2023).

The state of Assam in Northeast India is a biodiversity-rich region where two global biodiversity hotspots meet, namely, the Himalayan and the Indo-Burma regions (Myers et al. 2000). These areas have high species richness and contain endemic, migratory, and threatened species of various flora and fauna, including birds (Jenkins et al. 2013). Some 820 bird species are known to occur in Assam (Choudhury 2000), however, avian diversity studies have been limited to a few protected areas (Saikia and Saikia 2000; Barua and Sharma 2005; Choudhury 2006; Devi and Saikia 2010; Saikia and Devi 2011; Mahanta et al. 2019; Mahanta et al. 2022; Kakati et al. 2022).

The Bornadi Wildlife Sanctuary (BWS), an Important Bird and Biodiversity Area (IBA), is situated in Assam's Udalguri district. This area received IBA status due to the presence of the critically endangered Bengal Florican *Houbaropsis bengalensis* (Gmelin, 1789) (BirdLife International 2023). Despite being a vital habitat for avian species, the avian diversity of BWS is not well documented, with only a few species reports available (Chakraborty et al. 2015). The primary objective of this study is to document the diversity and better understand the avian community within BWS.

## STUDY AREA

Covering an area of 26.22 km<sup>2</sup>, Bornadi Wildlife Sanctuary is situated in the Bhabar zone of the eastern Himalayan foothill region in Assam (Figure 1). The Nalapara River runs along the eastern border of the sanctuary, while the Bornadi River marks its western boundary. BWS shares its northern border with the Jomotsangkha Wildlife Sanctuary in Bhutan, creating a transboundary forest complex. Settlements and

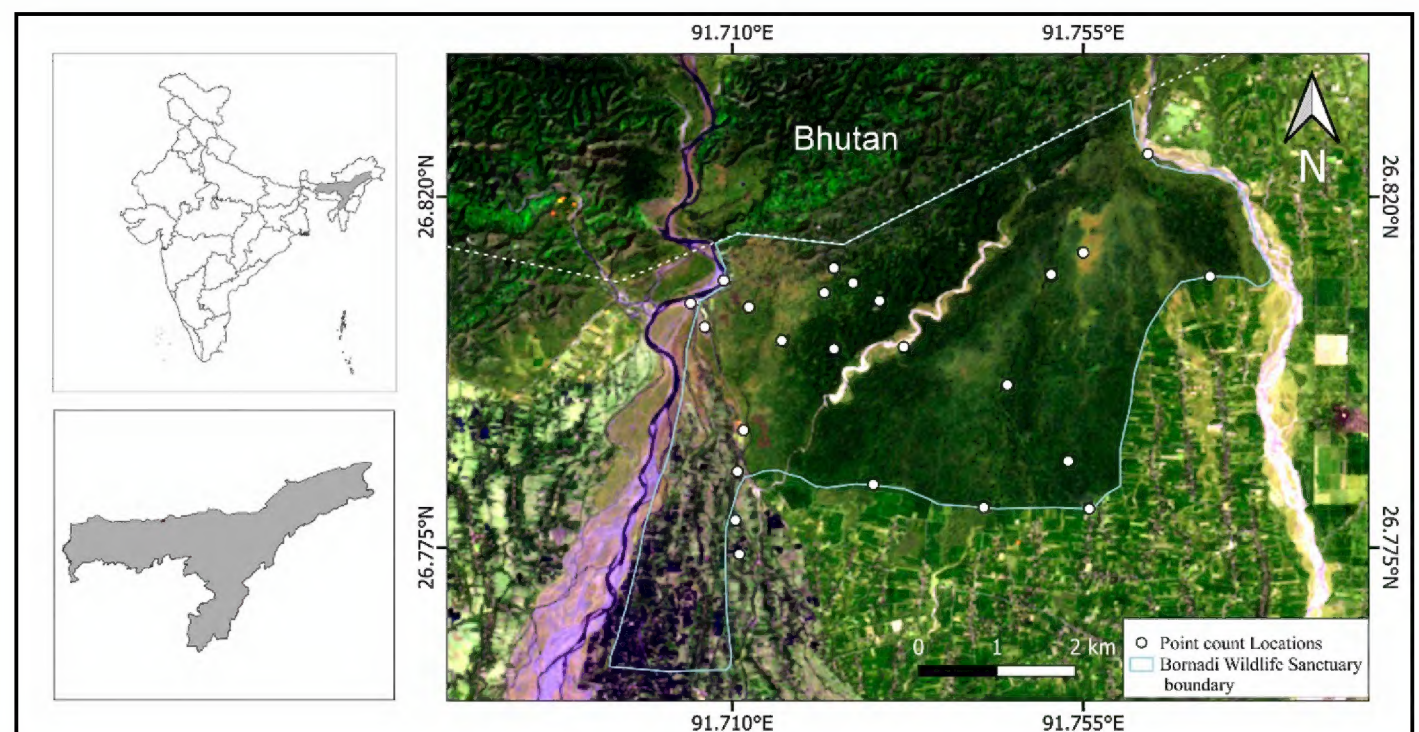


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**Figure 1.** Location of sampling stations in Bornadi Wildlife Sanctuary, Assam, India.



plantations, mainly tea gardens, are located along the southern boundary. BWS was declared a wildlife sanctuary in 1980 due to the presence of the endangered Pygmy Hog (*Porcula salvania* Hodgson, 1847) and Hispid Hare (*Caprolagus hispidus* Pearson, 1839). BWS is also home to several important Indian species, including *Panthera tigris tigris* (Linnaeus, 1758), *Panthera pardus fusca* (Meyer, 1794), *Neofelis nebulosa* (Griffith, 1821), *Elephas maximus indicus* (Cuvier, 1798), and *Bos gaurus* (C. H. Smith, 1827).

BWS has a subtropical, monsoon-type climate, with an average annual temperature of 22.5 °C and relative humidity ranging from 42% in February, to 96% in July. The average yearly rainfall measures 2,621 mm (Climate-Data.org 2023). BWS is categorised within the North-East-Brahmaputra Valley (9A) province of the Northeast India biogeographic zone (MoeF 2009).

Our study area can be categorised into forest, degraded forest, riparian, and forest edge habitats. The forest is the primary habitat type and covers almost half (45.61%) of the area of BWS (Sarma and Sarma 2008). The forest type is classified as Eastern Himalayan Moist Deciduous Forest (Champion and Seth 1968). A significant portion of BWS is covered by degraded forest, primarily in the western and southwestern parts. Surrounding much of the degraded forest are settlements and tea plantations. Riparian habitat lines BWS's eastern and western boundaries adjacent to the rivers. These riparian habitats host small grassy patches, mainly consisting of Kans grass *Saccharum spontaneum* L. and cogon grass *Imperata cylindrica* (L.) Raeusch. Additionally, BWS encompasses a limited expanse of scrubland and grassland. In our study, we combined scrubland areas with the degraded forest category, while grassland areas were classified with the riparian habitat group due to their proximity and similar characteristics.

## METHODS

Bird surveys were carried out between March 2019 and V.2022, in all four seasons: winter, pre-monsoon, monsoon, and retreating monsoon. Sampling throughout these seasons ensured that migratory bird species were also included. During the nationwide COVID-19 lockdown, field visits were severely limited from May to August 2020 and April to July 2021. For the bird survey, 24 sampling stations were established, covering all four habitat types within our study area (Table 1). These sampling points were randomly selected from six grids per habitat, with a grid size of 500 meters on the map. We conducted point transect surveys with a fixed radius of 30 m (Bibby et al. 2000). Birds were observed in the morning (0630 hours) and evening (1600 hours). Unfavourable weather conditions such as fog, rain, and high winds were avoided due to their known impact on bird activity and detection (Bibby et al. 2000). All birds seen or heard within a 30 m radius were identified and recorded. Each count lasted for 15 minutes. Birds were observed using Olympus 8×40 binoculars, and photographs were taken of most observed species. No specimens were collected during our study.

For species identification, Birds of the Indian Subcontinent (Grimmett et al. 2011) was used in the field. The Book of Indian Birds by Ali (1979) and other resources, such as Birds of the World (2022), were consulted to confirm certain species. The nomenclature and taxonomy were followed as per the eBird/Clements checklist of Birds of the World (Clements et al. 2022). Birds were categorised as resident (R), local migrant (LM), summer visitor (SV), or winter visitor (WV) based on our field observation and description from Grimmett et al. (2011). The conservation and national protection status of species were determined following the IUCN Red List of Threatened Species (2022) and the Wildlife Protection Act of 1972, respectively.

Diversity was measured for each habitat type using the Shannon Diversity Index (Shannon and Weaver 1963). Shannon Diversity Index ( $H'$ ) assumes that all species are evenly distributed in a sample and that the sample is randomly obtained. Shannon Diversity Index:  $H' = -\sum_{i=1}^s p_i \ln p_i$

Here,  $p_i$  is the proportion of individuals found of the  $i^{\text{th}}$  species,  $\ln$  is the natural logarithm, and  $s$  represents the number of species.



**Table 1.** Geographical location of sampling stations in BWS.

Sites	Latitude	Longitude	Elevation a.s.l. (m)	Habitat
S1	26.8108	091.7230	243	Forest
S2	26.8076	091.7218	204	Forest
S3	26.8066	091.7288	196	Forest
S4	26.8102	091.7351	210	Forest
S5	26.8005	091.7230	192	Forest
S6	26.7958	091.7452	186	Forest
S7	26.8100	091.7508	204	Forest
S8	26.7832	091.7528	178	Forest
S9	26.8098	091.7713	201	Edge
S10	26.7810	091.7556	176	Edge
S11	26.7801	091.7422	171	Edge
S12	26.7831	091.7281	172	Edge
S13	26.7741	091.7109	147	Edge
S14	26.7785	091.7104	152	Edge
S15	26.7847	091.7106	153	Degraded
S16	26.7900	091.7114	157	Degraded
S17	26.8015	091.7163	186	Degraded
S18	26.8058	091.7121	191	Degraded
S19	26.8137	091.7548	210	Degraded
S20	26.8093	091.7089	192	Riparian
S21	26.8063	091.7046	170	Riparian
S22	26.8033	091.7064	173	Riparian
S23	26.8017	091.7328	173	Riparian
S24	26.8299	091.7621	237	Riparian

## RESULTS

During the survey period, 2,582 individuals from 227 avian species across 65 families and 18 orders were documented (Table 2). Passerines made up 53.6% (120 species) of the total number of species. The Accipitridae family had the highest diversity among non-Passeriformes with 15 species, while the Muscicapidae family was the most diverse family within the Passeriformes with 17 species. Of the 227 species recorded, 72.3% were resident, while 27.7% were migratory. Among the migratory species, 52 were winter visitors, 9 were summer visitors, and certain species, like *Dendrocygna javanica* (Horsfield, 1821), were classified as local migratory (Table 3).

We observed highest species richness in the Forest habitat (117 species), followed by Edge (112 species), Degraded Forest (94 species), and Riparian habitat (81 species) (Table 2; Figure 3). In all, 43 species were exclusive to Riparian habitat, while Forest had 37, Edge had 27, and Degraded Forest had 19. Additionally, 20 species were present across all habitat types. Among specific abundances, *Pycnonotus cafer* (Linnaeus, 1766) was most abundant in degraded habitat, *Acridotheres tristis* (Linnaeus, 1766) in riparian habitat, and *Treron phoenicopterus* (Latham, 1790) in forest and edge habitats. The Shannon diversity index was highest for the Edge habitat ( $H' = 3.95$ ) and lowest for the Riparian habitat ( $H' = 3.34$ ). The rarefaction curve for our

**Table 2.** Summary of species richness, abundance and diversity in BWS.

Habitat type	Species richness	No. of Individuals	Shannon Diversity Index (H')
Edge	112 (27)	755	3.95
Degraded forest	94 (19)	510	3.89
Forest	117 (37)	765	3.94
Riparian	81 (43)	552	3.34

\*Numbers within parenthesis signify unique species observed only in the particular habitat



**Table 3.** Annotated list of birds from Bornadi Wildlife Sanctuary. Legend: IUCN: International Union for Conservation of Nature, LC: Least Concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered, WPA: Indian Wildlife Protection Act, 1972, SC-I: Schedule List I species, SC-IV: Schedule List IV species, SC-V: Schedule List V species, MS: Migratory Status, R: Resident, LM: Local Migrant, SV: Summer Visitor, WV: Winter Visitor, De: Degraded habitat, Ed: Edge habitat, Fo: Forest habitat, Ri: Riparian Habitat, RA: Relative Abundance.

Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
Anseriformes								
Anatidae								
<i>Dendrocygna javanica</i>	Lesser Whistling Duck	LC	Sc-IV	LM	—	—	—	0.91
Galliformes								
Phasianidae								
<i>Gallus gallus</i>	Red Junglefowl	LC	Sc-IV	R	0.20	0.26	0.39	—
<i>Lophura leucomelanos</i>	Kalij Pheasant	LC	Sc-I	R	—	—	0.13	—
<i>Pavo cristatus</i>	Indian Peafowl	LC	Sc-I	R	4.71	1.72	3.01	0.18
Columbiformes								
Columbidae								
<i>Treron phoenicoptera</i>	Yellow-footed Green Pigeon	LC	Sc-IV	R	5.10	14.04	16.08	0.54
<i>Treron apicauda</i>	Wedge-tailed Green Pigeon	LC	Sc-IV	R	0.59	—	0.39	—
<i>Treron curvirostra</i>	Thick-billed Green Pigeon	LC	Sc-IV	R	—	1.59	—	1.27
<i>Treron phayrei</i>	Ashy-headed Green Pigeon	NT	Sc-IV	R	—	—	0.26	—
<i>Treron apicauda</i>	Pin-tailed Green Pigeon	LC	Sc-IV	R	—	—	0.26	—
<i>Ducula badia</i>	Mountain Imperial Pigeon	LC	Sc-IV	R	—	0.26	—	—
<i>Ducula aenea</i>	Green Imperial Pigeon	NT	Sc-IV	R	—	—	0.26	—
<i>Columba livia</i>	Rock Pigeon	LC		R	0.39	0.40	—	—
<i>Streptopelia orientalis</i>	Oriental Turtle-Dove	LC	Sc-IV	R	0.39	0.66	0.39	—
<i>Streptopelia decaocto</i>	Eurasian Collared-Dove	LC	Sc-IV	R	—	—	0.65	—
<i>Streptopelia chinensis</i>	Spotted Dove	LC	Sc-IV	R	0.78	3.18	—	1.27
<i>Streptopelia tranquebarica</i>	Red Collared-Dove	LC	Sc-IV	R	0.20	—	—	1.27
<i>Chalcophaps indica</i>	Asian Emerald Dove	LC	Sc-IV	R	0.39	0.53	0.39	—
Cuculiformes								
Cuculidae								
<i>Centropus bengalensis</i>	Lesser Coucal	LC		R	0.20	—	—	—
<i>Centropus sinensis</i>	Greater Coucal	LC		R	—	0.13	—	—
<i>Hierococcyx varius</i>	Common Hawk-Cuckoo	LC	Sc-IV	LM	0.39	0.53	—	—
<i>Phaenicophaeus tristis</i>	Green-billed Malkoha	LC	Sc-IV	R	—	0.26	0.78	—
<i>Eudynamys scolopaceus</i>	Asian Koel	LC	Sc-IV	R	0.20	0.13	—	—
<i>Cacomantis merulinus</i>	Plaintive Cuckoo	LC	Sc-IV	R	0.20	—	0.13	—
<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo	LC	Sc-IV	R	0.20	—	—	—
<i>Cuculus micropterus</i>	Indian Cuckoo	LC	Sc-IV	SV	—	—	—	0.18
<i>Surniculus lugubris</i>	Square-tailed Drongo-cuckoo	LC	Sc-IV	SV	—	0.13	—	—
Caprimulgiformes								
Caprimulgidae								
<i>Caprimulgus affinis</i>	Savanna Nightjar	LC	Sc-IV	R	0.20	—	—	—
<i>Caprimulgus climacurus</i>	Large-tailed Nightjar	LC	Sc-IV	R	—	—	0.13	—
Apodidae								
<i>Collocalia brevirostris</i>	Himalayan Swiftlet	LC		R	—	—	0.39	—
<i>Apus nipalensis</i>	House Swift	LC		R	—	—	—	0.72
<i>Cypsiurus balasiensis</i>	Asian Palm-swift	LC		R	1.18	—	1.05	7.79
Gruiformes								
Rallidae								
<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	LC		R	—	—	—	0.18
Charadriiformes								
Burhinidae								
<i>Burhinus indicus</i>	Indian Thick-knee	LC		R	—	—	—	0.18
Ibidorhynchidae								
<i>Ibidorhyncha struthersii</i>	Ibisbill	LC		WV	—	—	—	0.18

Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
Charadriidae								
<i>Vanellus indicus</i>	Red-wattled Lapwing	LC		R	1.37	—	—	1.27
<i>Vanellus duvaucelii</i>	River Lapwing	NT		R	—	—	—	0.72
Scolopacidae								
<i>Tringa nebularia</i>	Common Greenshank	LC	Sc-IV	WV	—	—	—	0.18
<i>Tringa glareola</i>	Wood Sandpiper	LC	Sc-IV	WV	—	—	—	0.18
<i>Actitis hypoleucos</i>	Common Sandpiper	LC	Sc-IV	WV	—	—	—	0.18
Ciconiiformes								
Ciconiidae								
<i>Ciconia nigra</i>	Black Stork	LC	Sc-IV	WV	—	—	—	0.18
<i>Anastomus oscitans</i>	Asian Openbill Stork	LC	Sc-IV	R	—	—	—	0.36
Suliformes								
Phalacrocoracidae								
<i>Microcarbo niger</i>	Little Cormorant	LC	Sc-IV	R	0.39	—	—	1.45
<i>Phalacrocorax carbo</i>	Great Cormorant	LC	Sc-IV	WV	—	—	—	0.36
Pelecaniformes								
Ardeidae								
<i>Ardea purpurea</i>	Purple Heron	LC	Sc-IV	R	—	—	—	0.18
<i>Ardeola grayii</i>	Indian Pond Heron	LC	Sc-IV	R	—	—	—	0.18
<i>Bubulcus ibis</i>	Cattle Egret	LC	Sc-IV	R	0.20	0.26	—	2.36
<i>Ardea intermedia</i>	Intermediate Egret	LC	Sc-IV	R	—	—	—	0.18
<i>Egretta garzetta</i>	Little Egret	LC	Sc-IV	R	—	—	—	1.09
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	LC	Sc-IV	R	—	—	—	0.18
<i>Ixobrychus cinnamomeus</i>	Striated Heron	LC	Sc-IV	R	—	—	—	0.18
<i>Ixobrychus cinnamomeus</i>	Cinnamon Bittern	LC	Sc-IV	R	—	—	—	0.18
Accipitriformes								
Accipitridae								
<i>Gyps himalayensis</i>	Himalayan Griffon	NT	Sc-IV	WV	0.39	—	—	—
<i>Elanus caeruleus</i>	Black-winged Kite	LC		R	—	0.13	—	—
<i>Milvus migrans</i>	Black Kite	LC		R	—	0.13	—	—
<i>Accipiter nisus</i>	Eurasian Sparrowhawk	LC		R	—	—	—	0.36
<i>Accipiter trivirgatus</i>	Crested Goshawk	LC		R	—	—	0.13	—
<i>Accipiter badius</i>	Shikra	LC		R	0.20	—	0.13	—
<i>Accipiter virgatus</i>	Besra	LC		R	—	—	0.13	—
<i>Pernis ptilorhynchus</i>	Oriental Honey-buzzard	LC		R	—	0.26	—	0.36
<i>Spilornis cheela</i>	Crested Serpent-eagle	LC		R	0.98	0.13	0.78	0.36
<i>Nisaetus cirrhatus</i>	Changeable Hawk-eagle	LC		R	0.20	—	—	—
<i>Ictinaetus malaiensis</i>	Black Eagle	LC		R	—	—	0.26	—
<i>Hieraaetus pennatus</i>	Booted Eagle	LC		WV	0.20	—	—	—
<i>Clanga clanga</i>	Greater Spotted Eagle	VU		WV	—	—	0.13	—
<i>Lophotriorchis kienerii</i>	Rufous Bellied Eagle	NT		R	0.20	—	—	—
<i>Aquila nipalensis</i>	Steppe Eagle	EN		WV	—	—	—	0.18
Strigiiformes								
Tytonidae								
<i>Tyto alba</i>	Barn Owl	LC		R	—	0.13	—	—
Strigidae								
<i>Athene brama</i>	Spotted Owlet	LC	Sc-IV	R	—	0.13	—	—
<i>Otus sunia</i>	Oriental Scops Owl	LC	Sc-IV	R	—	0.13	—	—
<i>Glaucidium cuculoides</i>	Asian Barred Owlet	LC	Sc-IV	R	—	0.13	—	—
<i>Ninox scutulata</i>	Brown Hawk-owl	LC	Sc-IV	R	—	0.13	—	—
<i>Otus lettia</i>	Collared Scops-owl	LC	Sc-IV	R	—	—	0.13	—
<i>Ketupa nipalensis</i>	Spot-bellied Eagle Owl	LC	Sc-IV	R	—	0.13	—	—
Bucerotiformes								
Upupidae								
<i>Upupa epops</i>	Eurasian Hoopoe	LC		R	0.20	—	—	—



Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
Bucerotidae								
<i>Buceros bicornis</i>	Great Hornbill	VU	Sc-I	R	—	0.26	0.13	—
<i>Rhyticeros undulatus</i>	Wreathed Hornbill	VU	Sc-I	R	1.18	—	—	—
<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill	LC		R	—	0.13	0.65	—
Coraciiformes								
Alcedinidae								
<i>Halcyon smyrnensis</i>	White-throated Kingfisher	LC	Sc-IV	R	1.18	0.13	0.13	—
<i>Alcedo atthis</i>	Common Kingfisher	LC	Sc-IV	R	—	—	—	0.72
<i>Megaceryle lugubris</i>	Crested Kingfisher	LC	Sc-IV	R	—	—	—	0.18
Meropidae								
<i>Merops philippinus</i>	Blue-tailed Bee-eater	LC		SV	—	—	—	0.91
<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater	LC		SV	2.55	—	1.44	—
<i>Merops orientalis</i>	Green Bee-eater	LC		SV/LM	—	0.79	0.52	2.17
<i>Nyctyornis athertoni</i>	Blue Bearded Bee-eater	LC		R	—	0.26	0.39	—
Coraciidae								
<i>Coracias affinis</i>	Indochinese Roller	LC	Sc-IV	R	0.20	0.26	—	0.18
<i>Eurystomus orientalis</i>	Dollarbird	LC		R	—	—	0.13	—
Piciformes								
Megalaimidae								
<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	LC	Sc-IV	R	0.59	0.66	0.26	—
<i>Psilopogon asiaticus</i>	Blue-throated Barbet	LC	Sc-IV	R	1.76	2.78	2.88	—
<i>Psilopogon lineata</i>	Lineated Barbet	LC	Sc-IV	R	1.18	2.38	1.05	—
<i>Psilopogon duvaucelii</i>	Blue-eared Barbet	LC	Sc-IV	R	0.20	—	—	—
<i>Psilopogon virens</i>	Great Barbet	LC	Sc-IV	R	—	0.26	0.78	—
Picidae								
<i>Picumnus innominatus</i>	Speckled Piculet	LC	Sc-IV	R	—	—	0.13	—
<i>Yungipicus canicapillus</i>	Grey-capped Pigmy Woodpecker	LC	Sc-IV	R	—	0.93	0.13	—
<i>Dendrocopos macei</i>	Fulvous-breasted Woodpecker	LC	Sc-IV	R	0.39	1.46	0.26	—
<i>Micropternus brachyurus</i>	Rufous Woodpecker	LC	Sc-IV	R	0.20	0.13	0.13	—
<i>Chrysocolaptes guttacristatus</i>	Greater Flameback	LC	Sc-IV	R	—	0.26	—	—
<i>Dinopium benghalense</i>	Black-rumped Flameback	LC	Sc-IV	R	—	0.40	0.13	—
<i>Picus chlorolophus</i>	Lesser Yellownape	LC	Sc-IV	R	0.20	0.26	0.26	—
<i>Chrysophlegma flavinucha</i>	Greater Yellownape	LC	Sc-IV	R	—	—	0.26	—
<i>Picus canus</i>	Grey-headed Woodpecker	LC	Sc-IV	R	—	0.53	—	—
Falconiformes								
Falconidae								
<i>Falco tinnunculus</i>	Common Kestrel	LC	Sc-IV	WV	—	0.66	0.13	—
<i>Falco subbuteo</i>	Eurasian Hobby	LC		WV	0.20	—	—	—
<i>Microhierax melanoleucos</i>	Pied Falconet	LC	Sc-IV	R	—	0.13	—	—
<i>Falco peregrinus</i>	Peregrine Falcon	LC	Sc-I	WV/LM	—	—	—	0.18
Psittaciformes								
Psittaculidae								
<i>Psittacula alexandri</i>	Red-breasted Parakeet	NT	Sc-IV	R	0.39	—	0.26	—
<i>Psittacula krameri</i>	Rose-ringed Parakeet	LC	Sc-IV	R	—	0.40	—	—
Passeriformes								
Pittidae								
<i>Pitta sordida</i>	Hooded Pitta	LC	Sc-IV	SV	—	0.26	0.26	—
Campephagidae								
<i>Coracina macei</i>	Large Cuckooshrike	LC		R	0.78	0.26	3.14	—
<i>Lalage melaschistos</i>	Black-winged Cuckooshrike	LC		WV	0.20	—	—	—
<i>Pericrocotus speciosus</i>	Scarlet Minivet	LC	Sc-IV	R	1.37	0.66	0.92	—
<i>Pericrocotus ethologus</i>	Long-tailed Minivet	LC	Sc-IV	WV	—	0.79	0.26	—
<i>Pericrocotus brevirostris</i>	Short-billed Minivet	LC	Sc-IV	R	—	0.53	0.26	—
<i>Pericrocotus cinnamomeus</i>	Small Minivet	LC	Sc-IV	R	0.59	—	—	—



Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
Oriolidae								
<i>Oriolus xanthornus</i>	Black-hooded Oriole	LC	Sc-IV	R	0.20	1.19	0.39	—
<i>Oriolus traillii</i>	Maroon Oriole	LC	Sc-IV	R	—	—	0.52	—
Artamidae								
<i>Artamus fuscus</i>	Ashy Woodswallow	LC		R	0.39	—	0.39	0.54
Vangidae								
<i>Tephrodornis pondicerianus</i>	Common Woodshrike	LC		R	—	—	1.57	—
<i>Tephrodornis virgatus</i>	Large Woodshrike	LC		R	—	—	0.26	—
Aegithinidae								
<i>Aegahina tiphia</i>	Common Iora	LC		R	0.98	0.13	1.44	—
Rhipiduridae								
<i>Rhipidura albicollis</i>	White-throated Fantail	LC		R	—	0.13	0.13	—
Dicruridae								
<i>Dicrurus macrocercus</i>	Black Drongo	LC	Sc-IV	R	0.98	0.53	0.39	0.72
<i>Dicrurus hottentottus</i>	Hair-crested Drongo	LC	Sc-IV	R	2.16	1.72	3.14	—
<i>Dicrurus aeneus</i>	Bronzed Drongo	LC	Sc-IV	R	—	0.26	0.65	—
<i>Dicrurus remifer</i>	Lesser Racket-tailed Drongo	LC	Sc-IV	R	—	0.13	0.13	—
<i>Dicrurus paradiseus</i>	Greater Racket-tailed Drongo	LC	Sc-IV	R	0.20	—	0.52	—
<i>Dicrurus leucophaeus</i>	Ashy Drongo	LC	Sc-IV	WV	0.20	0.40	0.39	0.18
Monarchidae								
<i>Hypothymis azurea</i>	Black-naped Monarch	LC		R	0.39	0.53	—	—
Laniidae								
<i>Lanius cristatus</i>	Brown Shrike	LC		WV	0.39	0.26	0.13	—
<i>Lanius schach</i>	Long-tailed Shrike	LC		WV	0.20	0.40	—	0.54
<i>Lanius tephronotus</i>	Grey-backed Shrike	LC		WV	0.39	0.26	0.26	0.18
Corvidae								
<i>Dendrocitta formosae</i>	Grey Treepie	LC	Sc-IV	R	—	0.13	—	—
<i>Dendrocitta vagabunda</i>	Rufous Treepie	LC	Sc-IV	R	0.98	1.06	0.13	0.36
<i>Cissa chinensis</i>	Common Green Magpie	LC	Sc-IV	R	—	—	0.13	—
<i>Corvus splendens</i>	House Crow	LC	Sc-V	R	—	0.13	—	—
<i>Corvus macrorhynchos</i>	Large-billed Crow	LC		R	0.20	0.40	—	0.72
Stenostiridae								
<i>Culicicapa ceylonensis</i>	Grey-headed Canary Flycatcher	LC	Sc-IV	WV	0.78	2.25	1.44	0.18
Paridae								
<i>Parus cinereus</i>	Cinereous Tit	LC	Sc-IV	R	—	0.26	0.26	—
<i>Cephalopyrus flammiceps</i>	Fire-capped Tit	LC	Sc-IV	WV	—	—	0.13	—
Alaudindae								
<i>Alauda gulgula</i>	Oriental Skylark	LC		WV	0.39	—	—	0.36
Cisticolidae								
<i>Cisticola juncidis</i>	Zitting Cisticola	LC		R	0.20	—	—	—
<i>Orthotomus sutorius</i>	Common Tailorbird	LC		R	0.98	0.79	2.09	0.72
<i>Prinia inornata</i>	Plain Prinia	LC		R	—	—	—	0.36
Acrocephalidae								
<i>Acrocephalus agricola</i>	Paddyfield Warbler	LC		WV	0.20	—	—	—
<i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler	LC		WV	—	—	—	0.18
Hirundinidae								
<i>Hirundo rustica</i>	Barn Swallow	LC		WV	—	—	—	0.18
<i>Riparia chinensis</i>	Grey-throated Martin	LC		R	—	—	—	0.18
<i>Delichon nipalense</i>	Nepal House-Martin	LC		R	—	—	—	0.18
Pycnonotidae								
<i>Pycnonotus cafer</i>	Red-vented Bulbul	LC	Sc-IV	R	12.55	9.54	9.67	17.39
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	LC	Sc-IV	R	6.47	0.93	2.48	2.72
<i>Pycnonotus flaviventris</i>	Black-crested Bulbul	LC	Sc-IV	R	3.53	3.18	3.79	1.45
<i>Hypsipetes leucocephalus</i>	Black Bulbul	LC	Sc-IV	R	4.51	3.71	5.10	—
<i>Alophoixus flaveolus</i>	White-throated Bulbul	LC	Sc-IV	R	0.20	—	0.65	—



Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
Phylloscopidae								
<i>Phylloscopus trochiloides</i>	Greenish Warbler	LC		WV	0.78	0.13	0.78	—
<i>Phylloscopus inornatus</i>	Yellow-browed Warbler	LC		WV	0.20	—	0.52	—
<i>Phylloscopus affinis</i>	Tickell's Leaf Warbler	LC		WV	1.76	2.65	0.92	—
<i>Phylloscopus reguloides</i>	Blyth's Leaf Warbler	LC		WV	—	0.53	0.92	—
<i>Phylloscopus burkii</i>	Green-crowned Warbler	LC		WV	—	0.13	0.26	—
<i>Phylloscopus fuscatus</i>	Dusky Warbler	LC		WV	1.96	1.06	0.52	0.18
<i>Phylloscopus humei</i>	Hume's Warbler	LC		WV	—	—	0.26	—
<i>Phylloscopus cantator</i>	Yellow-vented Warbler	LC		WV	—	0.26	0.13	—
Scotocercidae								
<i>Phyllergates cucullatus</i>	Mountain Tailorbird	LC		R	—	—	0.13	—
<i>Abroscopus superciliaris</i>	Yellow-bellied Warbler	LC		R	—	—	1.05	—
Zosteropidae								
<i>Zosterops palpebrosus</i>	Indian White-eye	LC	Sc-IV	R	4.31	4.90	0.92	—
Timaliidae								
<i>Turdoides striata</i>	Jungle Babbler	LC	Sc-IV	R	—	1.99	0.39	—
<i>Mixornis gularis</i>	Pin-striped Tit-Babbler	LC	Sc-IV	R	0.98	0.40	0.39	—
Pellorneidae								
<i>Malacocincla abbotti</i>	Abbott's Babbler	LC		R	—	—	0.13	—
<i>Pellorneum ruficeps</i>	Puff-throated Babbler	LC		R	—	—	0.13	—
Locustellidae								
<i>Megalurus palustris</i>	Striated Grassbird	LC		R	—	0.26	—	—
Leiothrichidae								
<i>Alcippe nipalensis</i>	Nepal Fulvetta	LC		R	—	—	0.26	—
<i>Pterorhinus ruficollis</i>	Rufous-necked Laughingthrush	LC		R	1.18	0.66	—	—
<i>Pterorhinus pectoralis</i>	Greater Necklaced Laughingthrush	LC		R	—	—	1.31	—
<i>Garrulax monileger</i>	Lesser Necklaced Laughingthrush	LC		R	—	—	0.65	—
<i>Minla ignotincta</i>	Red-tailed Minla	LC		R	—	—	0.13	—
Tichodromidae								
<i>Tichodroma muraria</i>	Wallcreeper	LC		WV	—	—	—	0.18
Sittidae								
<i>Sitta cinnamoventris</i>	Chestnut-bellied Nuthatch	LC		R	—	0.13	—	—
<i>Sitta frontalis</i>	Velvet-fronted Nuthatch	LC		R	—	—	0.13	—
Sturnidae								
<i>Gracupica contra</i>	Asian Pied Starling	LC	Sc-IV	R	—	1.99	—	5.07
<i>Saroglossa spilopterus</i>	Spot-winged Starling	LC	Sc-IV	WV	—	—	0.52	—
<i>Sturnia malabarica</i>	Chestnut-tailed Starling	LC	Sc-IV	R	1.37	1.85	1.31	1.27
<i>Acridotheres tristis</i>	Common Myna	LC	Sc-IV	R	6.67	2.91	0.13	18.66
<i>Acridotheres fuscus</i>	Jungle Myna	LC	Sc-IV	R	2.55	0.66	0.65	2.72
<i>Acridotheres grandis</i>	Great Myna	LC	Sc-IV	R	—	0.13	—	—
<i>Gracula religiosa</i>	Common Hill Myna	LC	Sc-I	R	0.59	0.66	0.78	—
Turdinae								
<i>Myophonus caeruleus</i>	Blue Whistling Thrush	LC	Sc-IV	WV	—	0.26	—	—
<i>Turdus boulboul</i>	Grey-winged Blackbird	LC		R	—	—	0.13	—
<i>Geokichla citrina</i>	Orange-headed Thrush	LC	Sc-IV	SV	—	—	0.26	—
Muscicapidae								
<i>Ficedula albicilla</i>	Taiga Flycatcher	LC	Sc-IV	WV	0.39	1.32	1.05	0.18
<i>Ficedula strophciata</i>	Rufous-gorgeted Flycatcher	LC	Sc-IV	R	—	0.13	0.13	—
<i>Ficedula westermanni</i>	Little Pied Flycatcher	LC	Sc-IV	R	0.20	0.26	—	—
<i>Cyornis unicolor</i>	Pale Blue Flycatcher	LC	Sc-IV	SV	0.98	0.13	—	—
<i>Eumyias thalassinus</i>	Verditer Flycatcher	LC	Sc-IV	SV	—	—	0.26	—
<i>Niltava macgrigoriae</i>	Small Niltava	LC		WV	0.39	—	—	—
<i>Copsychus saularis</i>	Oriental Magpie-robin	LC		R	0.78	1.59	0.52	5.43
<i>Copsychus malabaricus</i>	White-rumped Shama	LC		R	0.20	0.53	0.39	—



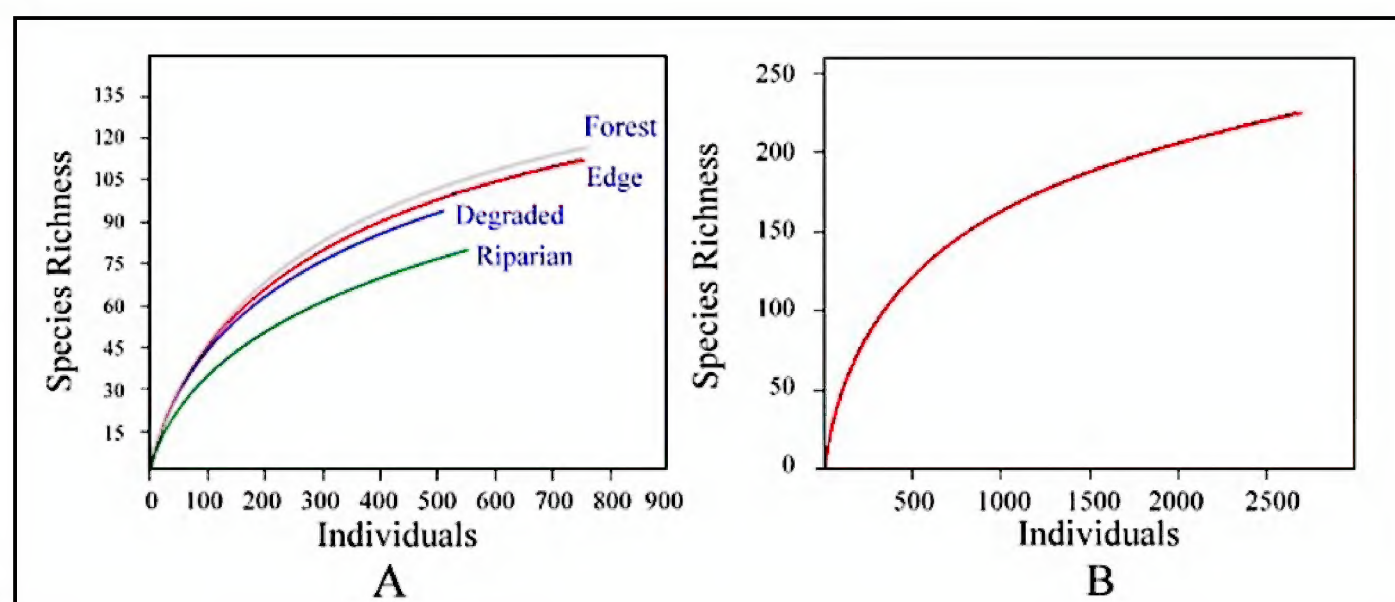
Order, family, species	Common Name	IUCN status	WPA status	MS	Habitat (RA%)			
					De	Ed	Fo	Ri
<i>Saxicola maurus</i>	Siberian Stonechat	LC		WV	—	—	—	0.36
<i>Saxicola ferreus</i>	Grey Bushchat	LC		R	—	—	—	0.72
<i>Calliope calliope</i>	Siberian Rubythroat	LC		WV	—	—	0.26	—
<i>Monticola solitarius</i>	Blue Rock Thrush	LC		WV	—	—	—	0.18
<i>Enicurus immaculatus</i>	Black-backed Forktail	LC		R	—	—	—	0.18
<i>Phoenicurus fuliginosus</i>	Plumbeous Redstart	LC		WV/LM	—	—	—	0.72
<i>Phoenicurus leucocephalus</i>	White-capped Redstart	LC		WV/LM	—	—	—	1.99
<i>Phoenicurus hodgsoni</i>	Hodgson's Redstart	LC		WV	—	—	—	0.36
<i>Phoenicurus ochruros</i>	Black Redstart	LC		WV	0.78	—	—	0.36
Dicaeidae								
<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker	LC	Sc-IV	R	—	0.13	0.13	—
<i>Dicaeum minullum</i>	Plain Flowerpecker	LC	Sc-IV	R	0.20	0.26	0.65	0.54
Nectariniidae								
<i>Aethopyga siparaja</i>	Crimson Sunbird	LC	Sc-IV	R	0.20	0.26	0.92	0.36
<i>Chalcoparia singalensis</i>	Ruby-cheeked Sunbird	LC	Sc-IV	R	—	0.13	—	—
<i>Cinnyris asiaticus</i>	Purple Sunbird	LC	Sc-IV	R	—	0.26	0.26	0.18
<i>Arachnothera magna</i>	Streaked Spiderhunter	LC		R	0.20	1.19	1.83	—
Irenidae								
<i>Irena puella</i>	Asian Fairy Bluebird	LC	Sc-IV	R	—	—	0.26	—
Chloropseidae								
<i>Chloropsis moluccensis</i>	Blue-winged Leafbird	LC		R	—	—	0.26	—
<i>Chloropsis aurifrons</i>	Golden-fronted Leafbird	LC		R	0.20	0.40	1.18	—
<i>Chloropsis hardwickii</i>	Orange-bellied Leafbird	LC		R	0.39	0.13	0.52	—
Ploceidae								
<i>Ploceus philippinus</i>	Baya Weaver	LC	Sc-IV	R	0.78	0.79	—	—
Estrildidae								
<i>Lonchura punctulata</i>	Scaly-breasted Munia	LC	Sc-IV	R	0.39	—	—	—
<i>Lonchura striata</i>	White-rumped Munia	LC	Sc-IV	R	0.39	—	—	—
<i>Lonchura atricapilla</i>	Chestnut Munia	LC	Sc-IV	R	—	0.26	—	—
Passeridae								
<i>Passer domesticus</i>	House Sparrow	LC		R	—	0.26	—	—
<i>Passer montanus</i>	Eurasian Tree Sparrow	LC		R	—	0.26	—	—
Motacillidae								
<i>Motacilla alba</i>	White Wagtail	LC		WV	0.59	—	0.13	2.36
<i>Motacilla cinerea</i>	Grey Wagtail	LC		WV	—	—	—	0.36
<i>Motacilla maderaspatensis</i>	White-browed Wagtail	LC		WV/LM	—	—	—	0.36
<i>Anthus richardi</i>	Richard's Pipit	LC	Sc-IV	WV	—	—	—	0.18
<i>Anthus rufulus</i>	Paddyfield Pipit	LC	Sc-IV	R	—	—	—	0.18
<i>Anthus hodgsoni</i>	Olive-backed Pipit	LC	Sc-IV	WV	—	0.26	—	—
<i>Anthus roseatus</i>	Rosy Pipit	LC	Sc-IV	WV	0.39	—	—	—
Fringillidae								
<i>Carpodacus erythrinus</i>	Common Rosefinch	LC	Sc-IV	WV	—	0.26	—	—

sampling effort across the entire study area did not reach a plateau at its peak, suggesting the possibility of finding a few more species with additional survey effort (Figure 2). The rank abundance plot indicated that a few species were highly abundant compared to others in each habitat type (Figure 4).

Regarding the IUCN Red List status, of the observed species, one species (*Aquila nipalensis* Hodgson, 1833) was Endangered, three species were Vulnerable, and six species belonged to the Near Threatened category (Table 3). Additionally, six species are listed as Schedule I species under the Wildlife Protection Act of 1972, ensuring high protection.

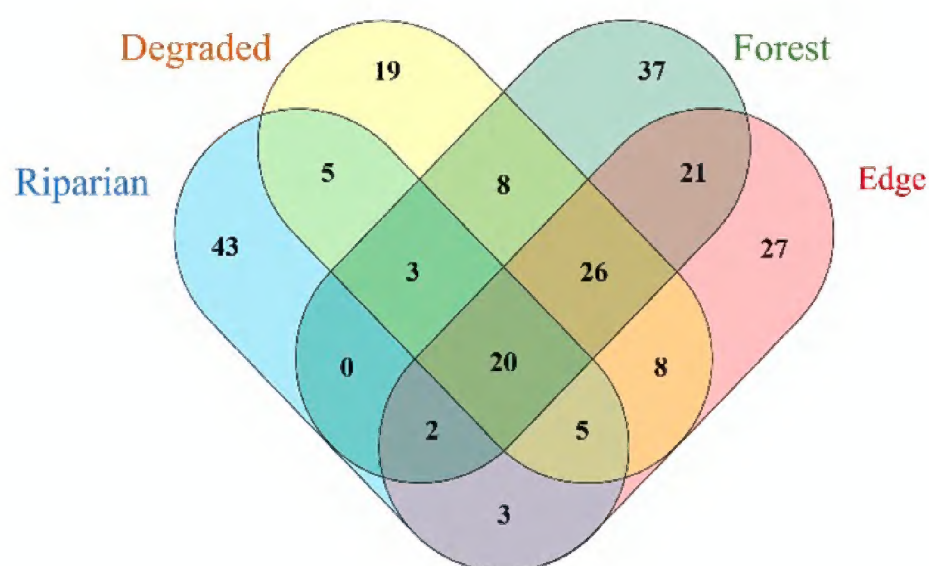
The observation notes of some species recorded from BWS are described below.



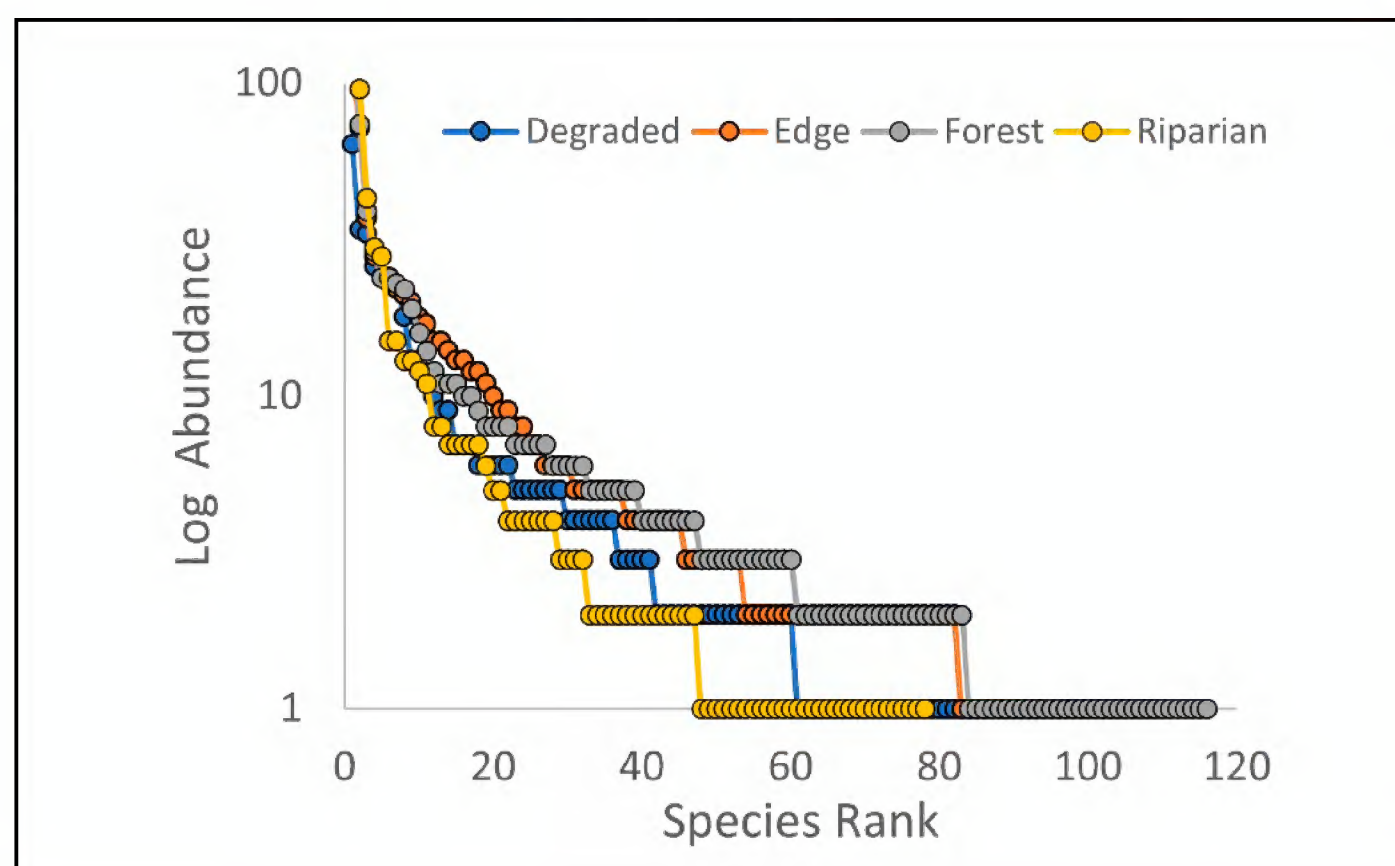


**Figure 2.** Species rarefaction curve for the survey sampling effort. **A.** Among different habitat types **B.** Entire study area of BWS.

**Figure 3.** Overlap of bird species across different habitats in BWS, shown with a Venn diagram depicting the number of species observed.



**Figure 4.** Distribution of bird species abundance across the various habitat types of BWS.



Family Phasianidae

### ***Gallus gallus* (Linnaeus, 1758)**

Red Junglefowl

Figure 5A

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 25.II.2021, 01.XI.2021, 09.III.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 21.XI.2019; V. Chetry obs.; forest edge • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.III.2019; V. Chetry & P. Mahananda obs.; degraded forest.

**Identification.** Males identified by orange hackles, blackish underpart and long, sickle-like tail. Females have rufous-coloured heads and lack blackish underparts.



***Pavo cristatus* (Linnaeus, 1758)**

Indian Peafowl

Figure 5B

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; 26.7900, 091.711419; 158 m a.s.l.; 6.IX.2019; V. Chetry & P. Mahananda obs.; forest edge.

**Identification.** Males with prominent, long green tail feathers with ocellus patterns. Females lack long tail feathers, and upper bodies are mostly brown.

Family Columbidae

***Treron sphenurus* (Vigors, 1832)**

Wedge-tailed Green-Pigeon

Figure 5C

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230 192 m a.s.l. 10 March 2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 25.II.2021; V. Chetry obs.; degraded forest.

**Identification.** Head and underparts bright greenish. Pale orange colouration at the crown in males, which females lack. Males also exhibit a distinctive wedge-shaped tail with maroon underparts.

Family Caprimulgidae

***Caprimulgus climacurus* Horsfield, 1821**

Large-tailed Nightjar

Figure 5D

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 27.I.2021; V. Chetry obs.; forest.

**Identification.** Tail large, with prominent buff on the outer feathers, upper parts are brown in colour. In males, white spots present on the four outermost primaries, whereas females exhibit buff spots.

Family Charadriidae

***Vanellus duvaucelii* (Lesson, 1826)**

River Lapwing

Figure 5E

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S23; 26.8017, 091.7328; 173 m a.s.l. 24.II.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

**Identification.** Face, throat and crest are black, bill and legs are also black.

Family Ciconiidae

***Ciconia nigra* (Linnaeus, 1758)**

Black Stork

Figure 5F

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S23; 26.801715, 091.732786; 173 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

**Identification.** Stork with glossy black body and white belly. Legs and bill red.

Family Phalacrocoracidae

***Phalacrocorax carbo* (Linnaeus, 1758)**

Great Cormorant

Figure 5G

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.809259, 091.708909; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

**Identification.** Glossy black body with yellow gular skin and distinct white cheeks. Larger than little cormorant.





**Figure 5.** Birds of BWS **A.** *Gallus gallus* **B.** *Pavo cristatus* **C.** *Treron apicauda* **D.** *Caprimulgus climacurus* **E.** *Vanellus duvaucelii* **F.** *Ciconia nigra* **G.** *Phalacrocorax carbo* **H.** *Ardeola grayii* **I.** *Bubulcus ibis* **J.** *Gyps himalayensis* **K.** *Milvus migrans* **L.** *Accipiter nisus*.

#### Family Ardeidae

##### ***Ardeola grayii* (Sykes, 1832)**

Indian Pond Heron

Figure 5H

**Observations.** INDIA – ASSAM • Udalhuri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 10.III.2022; 25.II.2021; V. Chetry obs.; riparian.

**Identification:** Brown body with streaked pattern, white wings, bill yellow with black tip.

##### ***Bubulcus ibis* (Linnaeus, 1758)**

Cattle Egret

Figure 5I

**Observations.** INDIA – ASSAM • Udalhuri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 24.II.2020, 06.VII.2020; V. Chetry obs.; riparian • Udalhuri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237m a.s.l.; 07.IX.2019 25.II.2021; V. Chetry obs.; riparian • Udalhuri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 31.X.2021; V. Chetry obs.; edge.

**Identification.** White-coloured, short-necked, stocky bird with a yellow bill. Breeding plumage has orange-buff on the head.



Family Accipitridae

***Gyps himalayensis* Hume, 1869**

Himalayan Griffon

Figure 5J

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.II.2020; V. Chetry obs.; degraded forest.

**Identification.** Large vulture with whitish wing-coverts and body, contrasts with dark flight feathers and tail.

***Milvus migrans* (Boddaert, 1783)**

Black Kite

Figure 5K

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 29.I.2020; V. Chetry obs.; edge.

**Identification.** Reddish-brown kite with distinct forked tail. Juveniles heavily streaked with contrasting brown and whitish colour.

***Accipiter nisus* (Linnaeus, 1758)**

Eurasian Sparrowhawk

Figure 5L

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 25.II.2021; V. Chetry obs.; riparian.

**Identification.** Average-sized accipiter with distinct barring on underparts, including both wings and tail. Male has a slaty-grey upperpart and orange barring underparts, female with dark brown upperparts and underpart barring.

***Accipiter virgatus* (Temminck, 1822)**

Besra

Figure 6A

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 30.XII.2019; V. Chetry & P. Mahananda obs.; edge.

**Identification.** Small in size, features a small bill and head. Upperparts dark, displaying a slaty-black colour, underparts heavily barred.

***Pernis ptilorhynchus* (Temminck, 1821)**

Oriental Honey-buzzard

Figure 6B

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 06.IX.2019, 07.XI.2019 V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 31.X.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 21.XI.2022; V. Chetry obs.; edge.

**Identification.** Head and bill small, face grey-coloured, tail marked with two black bands. Polymorphic, many variations in plumage colouration.

***Hieraaetus pennatus* (Gmelin, 1788)**

Booted Eagle

Figure 6C

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 25.II.2021; V. Chetry obs.; degraded forest.

**Identification.** Resembling a kite with long and narrow wings. Pale morph has whitish underparts, dark morph resembles a black kite in appearance. White patches on shoulders a distinct feature of all morphs.

***Lophotriorchis kienerii* (de Sparre, 1835)**

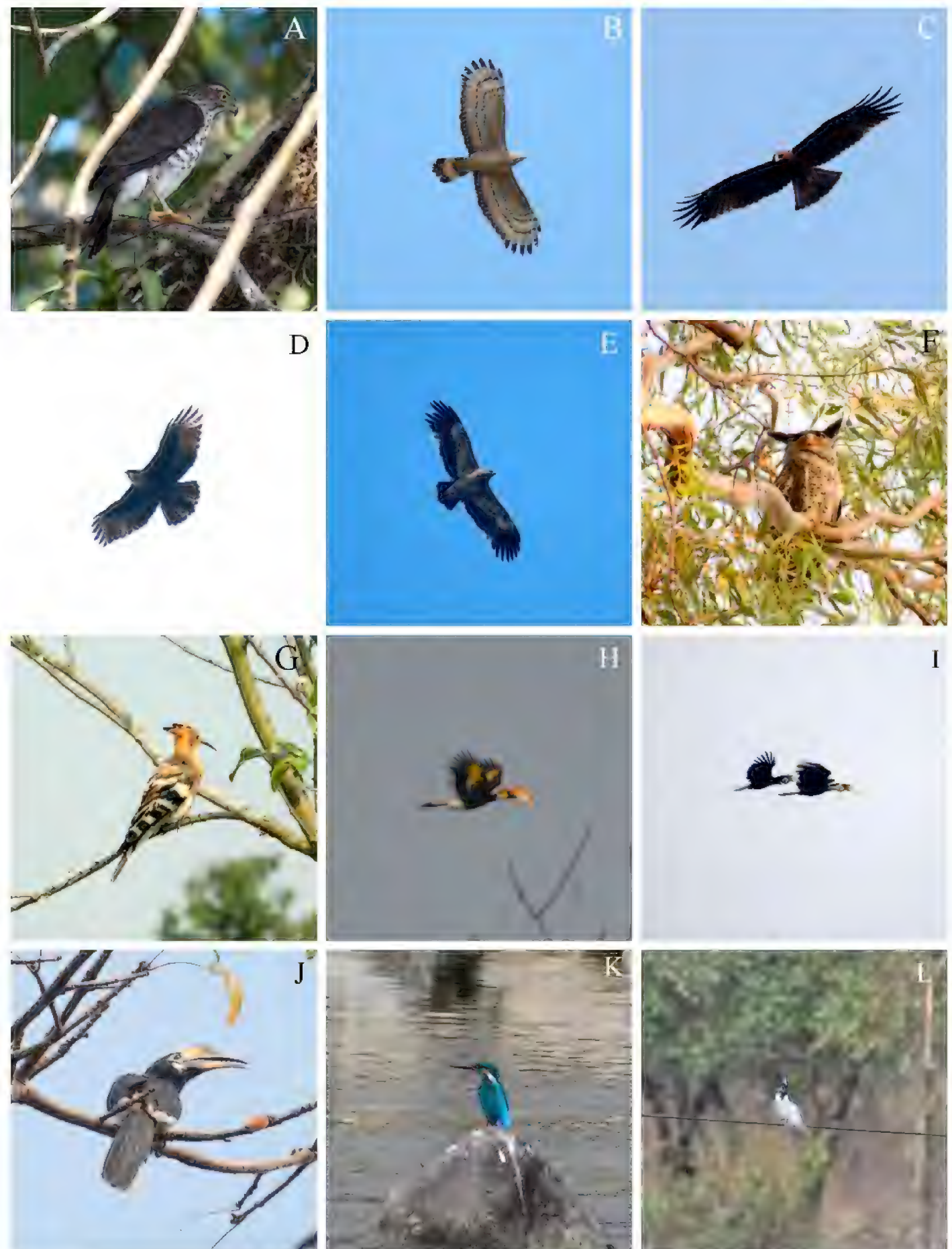
Rufous-bellied Eagle

Figure 6D

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 23.II.2020; V. Chetry obs.; edge.

**Identification.** Small eagle with dark blackish hood and upperparts, throat and breast white, accompanied by rufous-coloured underparts.





**Figure 6.** Birds of BWS **A.** *Accipiter virgatus* **B.** *Spilornis cheela* **C.** *Hieraaetus pennatus* **D.** *Lophotriorchis kienerii* **E.** *Clanga clanga* **F.** *Ketupa nipalensis* **G.** *Upupa epops* **H.** *Buceros bicornis* **I.** *Rhyticeros undulatus* **J.** *Anthracoceros albirostris* **K.** *Alcedo atthis* **L.** *Megaceryle lugubris*.

***Aquila nipalensis* Hodgson, 1833**

Steppe Eagle

Figure 6E

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 21.II.2020; V. Chetry obs.; edge.

**Identification.** Large-sized eagle with dark brown colour, primaries banded, iris brown. Pale rufous patch on the nape, light-coloured chin.

Family Strigidae

***Ketupa nipalensis* (Hodgson, 1836)**

Spot-bellied Eagle Owl

Figure 6F

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 10.III.2022; V. Chetry obs.; edge.

**Identification.** Large owl with dark brown upperparts and whitish buff underparts. Prominent ear tufts slant outward, tarsus fully feathered.



## Family Upupidae

***Upupa epops* Linnaeus, 1758**

Eurasian Hoopoe

Figure 6G

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 26.II.2021; V. Chetry obs.; degraded forest.

**Identification.** Rufous-coloured bird with distinct black and white wings and tail. Downward curved long bill, crest with black tip resembling a fan when erect.

## Family Bucerotidae

***Buceros bicornis* Linnaeus, 1758**

Great Hornbill

Figure 6H

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 11.III.2022; V. Chetry obs.; edge.

**Identification.** Large-sized hornbill with yellow bill, casque and neck. Body predominantly black, with a white tail bearing a black band. Male eyes have red iris, females have white.

***Rhyticeros undulatus* (Shaw, 1811)**

Wreathed Hornbill

Figure 6I

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 26.II.2021; V. Chetry obs.; degraded forest.

**Identification.** Large hornbill with black body, white tail, and whitish neck. Male distinguished by yellow gular pouch with black bar, female features a black neck and blue gular pouch.

***Anthracoceros albirostris* (Shaw, 1808)**

Oriental Pied-hornbill

Figure 6J

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.II.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 22.II.2020, 27.I.2021, 26.II.2021; V. Chetry obs.; forest.

**Identification.** Hornbill with distinctive black and white colouring, with ayellow bill and casque. Tail long and black, with white tips. Circumorbital skin blue.

## Family Alcedinidae

***Alcedo atthis* (Linnaeus, 1758)**

Common Kingfisher

Figure 6K

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 06.IX.2019, 28.I.2020, 24.II.2020; V. Chetry obs.; Hill stream.

**Identification.** Small blue-coloured kingfisher with barred blue-black crown and rufous ear coverts. Females similar except for a reddish lower mandible.

***Megaceryle lugubris* (Temminck, 1834)**

Crested Kingfisher

Figure 6L

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 24.II.2020; V. Chetry obs.; Riverbank.

**Identification.** Large black and white coloured kingfisher with a prominent crest. Males with rufous patch on the breast, females have a rufous underwing patch.



Family Meropidae

***Merops leschenaultia* Vieillot, 1817**

Chestnut-headed Bee-eater

Figure 7A

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 24.III.2019, 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 17.XII.2020, 09.IX.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 24.II.2021, 26.II.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 10.III.2022; V. Chetry obs.; degraded forest.

**Identification.** Green-coloured bird with long tail and downcurved bill. Crown, nape and mantle chestnut coloured, throat yellow. Sexes similar.

Family Coraciidae

***Eurystomus orientalis* (Linnaeus, 1766)**

Dollarbird

Figure 7B

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S3; 26.8066, 091.7288; 196 m a.s.l.; 10.V.2022; V. Chetry obs.; forest.

**Identification.** Dark greenish-blue coloured bird. Bill and eye ring red. Sexes similar.

Family Megalaimidae

***Psilopogon asiaticus* (Latham, 1790)**

Blue-throated Barbet

Figure 7C

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S17; 26.8015, 091.7163; 186 m a.s.l.; 16.XII.2020, 09.IX.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 10.III.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 22.II.2020, 24.II.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 31.X.2021, 11.II.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S13; 26.7741, 091.7109; 147 m a.s.l.; 12.V.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 21.XI.2019, 30.XI.2019, 10.V.2022, 11.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020, 21.II.2020, 17.XII.2020, 18.XII.2020, 25.II.2021, 01.XI.2021, 09.III.2021; V. Chetry obs.; forest.

**Identification.** Green-coloured bird with red forehead. Throat, upper breast, and auricular blue. Sexes similar.

***Psilopogon virens* (Boddaert, 1783)**

Great Barbet

Figure 7D

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 21.II.2020, 09.IX.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S1; 26.8108, 091.7230; 243 m a.s.l.; 09.III.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 11.III.2022; V. Chetry obs.; edge.

**Identification.** Largest barbet with a large yellow bill and dark bluish head. Wings, rump and tail green.

Family Picidae

***Picumnus innominatus* Burton, 1836**

Speckled Piculet

Figure 7E

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

**Identification.** Small bird with brown-greenish upper part and a very short black coloured tail. Dark eye stripe flanked by white-bordered stripes. Males have orange foreheads, females have uniform olive colouration on forehead and crown.





**Figure 7.** Birds of BWS **A.** *Merops leschenaultia* **B.** *Eurystomus orientalis* **C.** *Psilopogon asiaticus* **D.** *Psilopogon virens* **E.** *Picumnus innominatus* **F.** *Micropternus brachyurus* **G.** *Chrysocolaptes guttacristatus* **H.** *Picus canus* **I.** *Falco tinnunculus* **J.** *Microhierax melanoleucos* **K.** *Psittacula kramera* **L.** *Tephrodornis pondicerianus*.

***Micropternus brachyurus* (Vieillot, 1818)**

Rufous Woodpecker

Figure 7F

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 27.I.2021, V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 23.II.2020; V. Chetry obs.; edge.

**Identification.** Reddish-brown in colour with black bill. Black barred on entire body except for head and breast. Ear coverts red in males, buff infemales.

***Chrysocolaptes guttacristatus* (Tickell, 1833)**

Greater Flameback

Figure 7G

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 23.II.2020, 25.II.2020; V. Chetry obs.; edge.

**Identification.** Golden colouration on mantle and upper back. Black and white scale-like pattern on breast and underpart. Males have red foreheads and crests, females have black and white spotted foreheads and crests.



***Picus canus* Gmelin, 1788**

Grey-headed Woodpecker

Figure 7H

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 24.II.2020, 24.II.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 11.III.2022, 12.V.2022; V. Chetry obs.; edge.

**Identification.** Male has a red forehead and forecrown; black in females. Upper body olive-green, under-body a grey-greenish uniform colour.

Family Falconidae

***Falco tinnunculus* Linnaeus, 1758**

Common Kestrel

Figure 7I

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 01.XI.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832 091.7528; 178 m a.s.l.; 24 Mar 2019; V. Chetry obs.; forest.

**Identification.** Males with grey head and tail, upperwing reddish with black spots, underparts pale coloured, spotted. Females lack grey colouration, tail barring distinct from males.

***Microhierax melanoleucos* (Blyth, 1843)**

Pied Falconet

Figure 7J

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 15 Mar 2020; V. Chetry obs.; edge.

**Identification.** Small-sized falconet with black eye stripe, black upperparts and white underparts.

Family Psittacidae

***Psittacula krameri* (Scopoli, 1769)**

Rose-ringed Parakeet

Figure 7K

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 08.III.2022; V. Chetry obs.; edge.

**Identification.** Green-coloured bird with long tail and red-coloured upper bill. Male has a pink line on the nape, joining a black chin stripe. Female lacks a pink line and chin stripe.

Family Vangidae

***Tephrodornis pondicerianus* (“Gmelin, JF”, 1789)**

Common Woodshrike

Figure 7L

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

**Identification.** Brown-coloured bird with dark eye stripe, brown iris, and white supercilium.

***Tephrodornis virgatus* (Temminck, 1824)**

Large Woodshrike

Figure 8A

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 30.XII.2019; V. Chetry obs.; forest.

**Identification.** Throat, lower back and rump white, tail greyish-brown. Male has a black mask, female has a pale brown mask.



**Figure 8.** Birds of BWS **A.** *Tephrodornis virgatus* **B.** *Aegithina tiphia* **C.** *Dicrurus leucophaeus* **D.** *Dendrocitta vagabunda* **E.** *Culicicapa ceylonensis* **F.** *Pycnonotus jocosus* **G.** *Pycnonotus flaviventris* **H.** *Hypsipetes leucocephalus* **I.** *Phylloscopus trochiloides* **J.** *Phylloscopus reguloides* **K.** *Tichodroma muraria* **L.** *Saroglossa spilopterus*.

#### Family Aegithinidae

##### ***Aegithina tiphia* (Linnaeus, 1758)**

Common Iora

Figure 8B

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 29.I.2020, 17.XII.2020, 01.XI.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 09.III.2020, 10.V.2022, V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 16.XII.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S18; 26.8058, 091.7121; 191 m a.s.l.; 10.III.2022; V. Chetry obs.; degraded forest.

**Identification.** Yellowish-green males with black tail, females with green tail.



Family Dicruridae

***Dicrurus leucophaeus* Vieillot, 1817**

Ashy Drongo

Figure 8C

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S15; 26.7847, 091.7106; 153 m a.s.l.; 23.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S21; 26.8063, 091.7046; 170 m a.s.l.; 07.XI.2019; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 01.XI.2020; V. Chetry obs.; forest.

**Identification.** Drongo with slaty-grey upperparts and underparts. Iris distinctly bright red.

Family Corvidae

***Dendrocitta vagabunda* (Latham, 1790)**

Rufous Treepie

Figure 8D

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S5; 26.8005, 091.7230; 192 m a.s.l.; 24.III.2019; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 06.VII.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 01.XII.2019, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.XI.2019, 21.II.2020, 24.II.2020; V. Chetry obs.; edge.

**Identification.** Large treepie with long, black-tipped tail. Head and throat sooty-black, upper parts rufous, underparts pale and buff. Sexes are alike.

Family Stenostiridae

***Culicicapa ceylonensis* (Swainson, 1820)**

Grey-headed Canary-flycatcher

Figure 8E

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 30.XII.2019, 29.I.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 28.I.2020 • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 21.II.2020, 18.XII.2020, 21.XI.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S15; 6.784733, 091.7106; 153 m a.s.l.; 31.X.2020, 01.XI.2020; V. Chetry obs.; degraded forest.

**Identification.** Medium-sized flycatcher with an upright stance. Head and breast grey, underparts yellow and upperpart primarily green. Bill black.

Family Pycnonotidae

***Pycnonotus jocosus* (Linnaeus, 1758)**

Red-whiskered Bulbul

Figure 8F

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 24.II.2020; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XI.2019, 18.XII.2020, 10.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 31.X.2021; V. Chetry obs.; edge.

**Identification.** Medium-sized bulbul with brown upperpart and whitish underpart. Black crest, red patch behind eye, and white lower ear coverts with distinct moustache strips present.

***Rubigula flaviventris* (Tickell, 1833)**

Black-crested Bulbul

Figure 8G

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019; V. Chetry obs.; riparian • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XI.2019, 18.XII.2020, 11.V.2022; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 29 Jan 2020; V. Chetry obs.; edge.

**Identification.** Head, bill and crest black. Upperparts olive green, underparts mostly yellow. Iris yellow. Both sexes are similar.

***Hypsipetes leucocephalus* (Gmelin, 1789)**

Black Bulbul

Figure 8H

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 29.I.2020, 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020, 10.III.2022; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S14; 26.7785, 091.7104; 152 m a.s.l.; 22.II.2020; V. Chetry obs.; edge.

**Identification.** Grey-black bulbul with a small crest. Bill, legs, and feet red.

Family Phylloscopidae

***Phylloscopus trochiloides* (Sundevall, 1837)**

Greenish Warbler

Figure 8I

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S19; 26.8137, 091.7548; 210 m a.s.l.; 16.XII.2020, 30.X.2021; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 17.XII.2020, 01.XI.2021; V. Chetry obs.; forest. S9; 26.8098, 091.7713; 201 m a.s.l.; 18.XII.2020. V. Chetry obs.; edge.

**Identification.** Green-coloured upper body, underparts pale or whitish. Long whitish supercilium that meets over the bill, single white wing bar.

***Phylloscopus reguloides* (Blyth, 1842)**

Blyth's Leaf Warbler

Figure 8J

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 21.II.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 24.II.2020; V. Chetry obs.; edge.

**Identification.** Medium-sized warbler with yellow supercilium and crown stripe. Upperparts olive-green, underparts yellowish.

Family Tichodromidae

***Tichodroma muraria* (Linnaeus, 1766)**

Wallcreeper

Figure 8K

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 24.II.2021, 08.III.2022; V. Chetry & P. Mahananda obs.; riparian.

**Identification.** Grey-coloured bird with long, black, downcurved bill and red wing coverts.

Family Sturnidae

***Saroglossa spilopterus* (Vigors, 1831)**

Spot-winged Starling

Figure 8L

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S6; 26.7958, 091.7452; 186 m a.s.l.; 30.XII.2019, 18.XII.2020; V. Chetry obs.; forest.

**Identification.** Male has blackish-grey face, reddish-brown throat underparts, pale-brown and greyish upperparts. Female has brown upperparts. White iris and wing patch present in both sexes.

***Gracula religiosa* Linnaeus, 1758**

Common Hill Myna

Figure 9A

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 30.XI.2019, 18.XII.2020; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S4; 26.8102, 091.7351; 210 m a.s.l.; 27.I.2021, 09.III.2022, 10.V.2022. V. Chetry obs.; forest.





**Figure 9.** Birds of BWS **A.** *Gracula religiosa* **B.** *Cyornis unicolor* **C.** *Copsychus saularis* **D.** *Saxicola maurus* **E.** *Monticola solitarius* **F.** *Saxicola ferreus* **G.** *Phoenicurus leucocephalus* **H.** *Chalcoparia singalensis* **I.** *Arachnothera magna* **J.** *Irena puella* **K.** *Chloropsis aurifrons* **L.** *Motacilla alba*.

**Identification.** Large myna with black body, orange bill, yellow wattles, and a distinct white patch on the wing.

Family Muscicapidae

***Cyornis poliogenys* W.E. Brooks, 1880**

Pale-chinned Blue Flycatcher

Figure 9B

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S17; 26.8015, 091.7163; 186 m a.s.l.; 16.XII.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S12; 26.7831, 091.7281; 172 m a.s.l.; 25.I.2021; V. Chetry obs.; edge.

**Identification.** Body mostly olive-brown, crown and ear coverts grey, pale orange throat with creamy-orange breast.

***Copsychus saularis* (Linnaeus, 1758)**

Oriental Magpie-robin

Figure 9C

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.;

21.XI.2019, 02.XII.2019, 12.V.2022; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S11; 26.7801, 091.7422; 171 m a.s.l.; 21.II.2020, 25.II.2021; V. Chetry obs.; edge • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832091.7528; 178 m a.s.l.; 30.XII.2019, 10.V.2020, 17.XII.2020; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 22.II.2020; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 06.VII.2020; V. Chetry obs.; riparian.

**Identification.** Male has black head, upperparts and breasts. Belly white-coloured, white bands present on the wing. Females similar, except black colour replaced by grey.

***Saxicola maurus* (Pallas, 1773)**

Siberian Stonechat

Figure 9D

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S24; 26.8299, 091.7621; 237 m a.s.l.; 29.I.2020; V. Chetry obs.; riparian.

**Identification.** Male with black head, nape and back. Wwhite patch seen on lateral side of neck; breast orange, belly gradually white from the orange breast region. Female has brown head and upperpart with faint pale brown supercilium.

***Monticola solitarius* (Linnaeus, 1758)**

Blue Rock Thrush

Figure 9E

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

**Identification.** Males greyish-blue, darker in tail and wing regions. Female with dull brownish-grey upperpart and buff scaling underpart.

***Saxicola ferreus* J.E. Gray & G.R. Gray, 1847**

Grey Bushchat

Figure 9F

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020; V. Chetry obs.; riparian.

**Identification.** Male has greyish-black upperparts with a white supercilium. Underparts mostly whitish, with slightly dark skin at the breast. Bill and legs black. Female lacks a greyish-black upperpart, but with rufous colouration and buff throat and supercilium.

***Phoenicurus leucocephalus* Vigors, 1831**

White-capped Redstart

Figure 9G

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20; 26.8093, 091.7089; 192 m a.s.l.; 28.I.2020, 24.II.2020, 08.III.2022; V. Chetry obs.; riparian.

• Udalguri, Bornadi Wildlife Sanctuary; S22; 26.8033, 091.7064; 173 m a.s.l.; 07.IX.2019, 07.XI.2019; V. Chetry & P. Mahananda obs.; riparian.

**Identification.** Bill, head, upper body, and legs black. Adult has a white cap, underparts are orange-chestnut. Sexes are alike.

Family Nectariniidae

***Chalcoparia singalensis* (Gmelin, 1789)**

Ruby-cheeked Sunbird

Figure 9H

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 02.XII.2019; V. Chetry obs.; edge.

**Identification.** Sunbird with a short black bill, red iris, orange throat, and yellow underparts. Male has shiny green upperparts and ruby cheeks; female has olive upperparts and lacks ruby colouration on the cheeks.

***Arachnothera magna* (Hodgson, 1836)**

Streaked Spiderhunter

Figure 9I

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S10; 26.7810, 091.7556; 176 m a.s.l.; 02.XII.2019, 29.I.2020, 21.II.2020; V. Chetry obs.; edge.



• Udalguri, Bornadi Wildlife Sanctuary; S7; 26.8100, 091.7508; 204 m a.s.l.; 30.XII.2019, 17.XII.2019; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S19 26.8137, 091.7548; 210 m a.s.l.; 09.IX.2021; V. Chetry obs.; degraded forest.

**Identification.** Small bird with a long, downcurved bill, streaked olive upperparts, and streaked whitish underparts.

Family Irenidae

***Irena puella* (Latham, 1790)**

Asian Fairy Bluebird

Figure 9J

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S8; 26.7832, 091.7528; 178 m a.s.l.; 29.I.2020; V. Chetry obs.; forest.

**Identification.** Male with blue upperparts and black underparts. Females dull blue coloured. Red eye distinct in both sexes.

Family Chloropseidae

***Chloropsis aurifrons* (Temminck, 1829)**

Golden-fronted Leafbird

Figure 9K

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S16; 26.7900, 091.7114; 157 m a.s.l.; 24.III.2019; V. Chetry obs.; degraded forest • Udalguri, Bornadi Wildlife Sanctuary; S2; 26.8076, 091.7218; 204 m a.s.l.; 21.XI.2019, 25.II.2021; V. Chetry obs.; forest • Udalguri, Bornadi Wildlife Sanctuary; S9; 26.8098, 091.7713; 201 m a.s.l.; 02.XII.2019, 29.I.2020; V. Chetry obs.; edge.

**Identification.** Green bird with prominent golden forehead, blue malar, and black throat.

Family Motacillidae

***Motacilla alba* Linnaeus, 1758**

White Wagtail

Figure 9L

**Observations.** INDIA – ASSAM • Udalguri, Bornadi Wildlife Sanctuary; S20 26.8093, 091.7089; 192 m a.s.l.; 10.III.2023; V. Chetry obs.; riparian.

**Identification.** Head has a black-and-white pattern with a white forehead; mantle is black. Legs and bill black. Tail is long, and the upperpart is black.

## DISCUSSION

BWS is a contiguous Transboundary Manas Conservation Area (TraMCA) forest spread over 6,500 km<sup>2</sup> in the eastern Himalayas (Ahmed et al. 2016). Due to its contiguity and diverse habitat types, high avian diversity is known in the study area. The high number of species that were found exclusively in riparian habitat, highlights the importance of habitat heterogeneity in promoting species richness. Such heterogeneity accommodates the specific requirements of various species, offering abundant food sources in forested, waterbody, and farmland areas, leading to enhanced bird richness (Tu et al. 2020). The present study demonstrates that the contiguity of the forested area of the sanctuary directly influences species richness in the forest habitat. Similar trends have been noted by Joshi et al. (2022) for specialist birds. Additionally, studies by Basile et al. (2021) and Asmare et al. (2023) have reported analogous findings, highlighting greater richness in forested habitats. Forest interiors provide enough food year round along with better nesting success. Conversely, open forests and edge habitats render birds more vulnerable due to challenges in finding consistent food sources and increased nest predation (Flaspohler et al. 2001). The BWS is situated in the foothill region of the eastern Himalayas, which might explain the high bird diversity in the sanctuary, particularly of the forest species, which is also evident from other studies (Bell 1984).

The avian species richness recorded here represents 27% of all the bird species known to occur in Assam (Choudhury 2000) and approximately 17% of bird species recorded from India (Grimmett et al. 2011). Despite its small size (26.22 km<sup>2</sup>), BWS showcases remarkable avian species diversity. This study reveals that nearly 22% of bird species in BWS are winter visitors. Many warbler species found in BWS, including *Phylloscopus trochiloides*, *P. reguloides*, *P. inornatus* and *P. humei*, visit the region during winters, predominantly occupying forested areas and edges, thereby increasing species richness in these habitats.

Other migratory birds include water-dependent species such as *Phoenicurus ochruros*, *Phoenicurus*



*hodgsoni*, *Motacilla alba*, and *Motacilla cinerea*. These species are commonly found near rivers with boulders and rocky banks. The rivers within BWS provide an ideal habitat for such species, given that they primarily consist of hill streams originating from high-altitude areas within the eastern Himalayan region of Bhutan before entering the sanctuary. Birds from higher altitudes in the Himalayas often migrate to lower elevations during winter. Certain species, such as the Spot-winged Starling (*Saroglossa spilopterus*), undertake longitudinal migrations along the Himalayas, descending to lower elevation areas as part of this process (Grimmett et al. 2011). Sighting of *Ibidorhyncha struthersii*, a winter visitor from high elevation river valleys in the Himalayas, is an interesting find, as it has previously only been reported from Manas National Park (eBird Basic Dataset 2022) and Nameri National Park in Assam (Barua and Sharma 2005).

The overall diversity pattern of BWS is influenced by several factors, including the contiguity of forests and the presence of heterogeneous habitats. The significance of the region is highlighted by the presence of globally threatened and nationally protected species. The absence of detection of *Houbaropsis bengalensis* in BWS during our study raises concerns about the quality of specific habitats. *H. bengalensis* requires grassland habitat, which is presently in degraded condition in the BWS (Collar et al. 2020). Protected areas sharing borders with human settlements and farmlands limit the movement and abundance of forest-dependent avian species while fostering generalist species' diversity and abundance in edge areas. Proper habitat evaluation and management practices are crucial for reviving and sustaining delicate habitats prone to degradation. These efforts will positively impact the avian community and further aid in the conservation of birds in the region.

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## ADDITIONAL INFORMATION

### Conflict of interest

The authors declare that no competing interests exist.

### Ethical statement

No ethical statement is reported.

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### Author contributions


Conceptualization: VC, PKS. Methodology: VC. Investigation: VC. Field data collection: VC, PM. Data Curation: VC. Formal analysis: VC. Writing of original draft: VC, KS, PM. Writing- review and editing: VC, PKS, KS, MKS, PM. Visualization: VC. Supervision: PKS, MKS.


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### Data availability

All data that support the findings of this study are available in the main text.

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